

## CONTENTS

Ultimate Analysis of the Mineral Constituents of a Hagerstown Silty Clay Loam Soil and Occurrence in Plants of Some of the Elements Found. WALTER THOMAS.....	1
Effect of Chemical Agents on Oxidation in Soil-Forming Rocks and Minerals. GEORGE JOHN BOUYOUCOS.....	19
Effect of Reaction on Growth, Nodule Formation, and Calcium Content of Alfalfa, Alsike Clover and Red Clover. O. C. BRYAN.....	23
Effect of Acid Soils on Nodule-Forming Bacteria. O. C. BRYAN.....	37
Acid Phosphate Production by the Lipman Process: II. Building up Sulfur-Floats-Soil Mixtures with a High Content of Total and Soluble Phosphate. JACOB S. JOFFE..	41
Microbiological Analysis of Soil as an Index of Soil Fertility: IV. Ammonia Accumulation (Ammonification). SELMAN A. WAKSMAN.....	49
On the Eightieth Anniversary of the Birth of Dr. Paul Wagner. H. G. HUSTON.....	67
Further Notes on the Growing of Wheat in One-Salt Solutions. W. F. GERICKE.....	69
Relations Between Calcium Carbonate, Certain Fertilizer Chemicals and the Soil Solution. FRED W. MORSE.....	75
Acid Phosphate Production by the Lipman Process: III. The Use of Greensand Marl as the Inert Material in Building up Sulfur-Floats Mixtures. JACOB S. JOFFE.....	93
Soil Acidity as Measured by Sugar Inversion, the Truog Test and the Hydrogen-Ion Concentration and Its Relation to the Hydrolysis of Ethyl Acetate. F. W. PARKER AND O. C. BRYAN.....	99
Studies on the Toxic Properties of Soils. A. W. BLAIR AND A. L. PRINCE.....	109
A Method for the Determination of "Active" Aluminum in Acid Soils. PAUL S. BURGESS.....	131
The Effect of Gypsum on Iowa Soils. L. W. ERDMAN.....	137
Adsorption and Replacement of Plant Food in Colloidal Oxides of Iron and Aluminum. D. C. LICHTENWALNER, A. L. FLENNER, AND NEIL E. GORDON.....	157
Availability of Potassium in Orthoclase for Plant Nutrition. DENNIS EDWARD HALEY.....	167
A Comparison of the Absorption of Inorganic Elements, and of the Buffer Systems of Legumes and Non-Legumes, and Its Bearing upon Existing Theories. J. D. NEWTON.....	181
Sulfur, Calcium, Magnesium and Potassium Content and Reaction of Rainfall at Different Points in Tennessee. W. H. MACINTIRE AND J. B. YOUNG.....	205
The Soil Solution and its Importance in the Growth of Plants. N. M. TULAIOV.....	229
On the Question of Obtaining the Soil Solution. N. M. TULAIOV AND M. S. KUZMIN.....	235
Microbiological Analysis of Soils as an Index of Soil Fertility: V. Methods for the Study of Nitrification. SELMAN A. WAKSMAN.....	241
Aeration Method for Determining Ammonia in Alkali Soils. WILLIAM M. GIBBS, RAY E. NEIDIG AND H. W. BATCHELOR.....	261
Method for Estimating Adsorbed Bases in Soils and the Importance of these Bases in Soil Economy. D. J. HISSINK.....	269
Nodule-Production Kinship between the Soy Bean and the Cowpea. LEWIS T. LEONARD.....	277
The Relation of Seed Weight to the Growth of Buckwheat in Culture Solution. DAVID SCHMIDT.....	285
Solubility of Limestones as Related to Their Physical Properties. M. FRANCIS MORGAN AND ROBERT M. SALTER.....	293

A Comparison of Magnesian and Non-Magnesian Limestone in some 5-Year Rotations. J. G. LIPMAN, A. W. BLAIR, H. C. MCLEAN AND A. L. PRINCE.....	307
Influence of Soil Condition on Bacterial Life and Changes in Soil Substance: II. Ability of Soil to Break Down Mannite. HARALD R. CHRISTENSEN.....	329
Determination of Organic Matter in Decomposition Experiments with Soil. K. A. BONDORFF AND HARALD R. CHRISTENSEN.....	361
Reversion of Acid Phosphate in Acid Soils. THOMAS D. HALL AND J. C. VOGEL.....	367
Availability of Adsorbed Phosphorus. R. C. WILEY AND NEIL E. GORDON.....	371
The Effect of Different Reactions on the Growth and Calcium Content of Oats and Wheat. O. C. BRYAN.....	375
Effect of Adsorption and Other Factors on Certain Plant Food Constituents Obtained in the Dilute Nitric Acid Digestion of Soils and an Improvement for their Estima- tion. O. M. SHEDD.....	383
Variability of Nitrates and Total Nitrogen in Soils. ARTHUR L. PRINCE.....	395
Comparison of "Active" Aluminum and Hydrogen-Ion Concentrations of Widely Separated Acid Soils. PAUL S. BURGESS.....	407
The Influence of Solution Volume upon Plant Growth in Relation to Reaction Change and Iron Availability in Culture Solutions. R. M. BARNETTE AND J. W. SHIVE....	413
The Transient Nature of Magnesium-Induced Toxicity and its Bearing Upon Lime- Magnesia Ratio Studies. W. H. MACINTIRE AND J. B. YOUNG.....	427
A Note on Soil Reaction Studies. P. E. KARRAKER.....	473
The Destruction of Pentosans by Molds and Other Microorganisms. E. G. SCHMIDT, W. H. PETERSON AND E. B. FRED.....	479
Micro-Sampling for the Determination of Dissolved Oxygen. R. V. ALLISON AND J. W. SHIVE.....	489

## ILLUSTRATIONS

## PLATES

EFFECT OF REACTION ON GROWTH, NODULE FORMATION, AND CALCIUM CONTENT OF  
ALFALFA, ALSIKE CLOVER AND RED CLOVER

	page
Plate 1. Alfalfa grown in sand cultures of different reactions indicated by numbers which give the approximate pH values.....	30
Plate 2. Alsike clover grown in sand cultures of different reactions indicated by numbers which give the approximate pH values.....	32
Plate 3. Red Clover grown in sand cultures of different reactions indicated by numbers which give the approximate pH values.....	34

## STUDIES ON THE TOXIC PROPERTIES OF SOILS

Plate 1. Fig. 1. Unlimed sulfate of ammonia plot. Fig. 2. Limed sulfate of ammonia plot.....	111
Plate 2. Fig. 1. Culture-solution, series 1. Fig. 2. Culture-solution, series 2. Fig. 3. Culture-solution, series 3.....	113
Plate 3. Fig. 1. Culture-solution, series 3. Fig. 2. Culture-solution, series 4. Fig. 3. Culture-solution, series 4.....	115
Plate 4. Fig. 1. Pot experiment, series 2. Fig. 2. Pot experiment, series 3.....	116

## AVAILABILITY OF ADSORBED PHOSPHORUS

Plate 1. Sweet potato plants at completion of experiments.....	373
----------------------------------------------------------------	-----

### THE EFFECT OF DIFFERENT REACTIONS ON THE GROWTH AND CALCIUM CONTENT OF OATS AND WHEAT

- Plate 1. Fig. 1. Oats grown at different reactions in quartz sand which was removed for making the photograph. Fig. 2. Wheat grown at different reactions in quartz sand which was removed for making the photograph. .... 381

### THE TRANSIENT NATURE OF MAGNESIUM-INDUCED TOXICITY AND ITS BEARING UPON LIME-MAGNESIA RATIO STUDIES

- Plate 1. Showing initial toxicity induced by non-carbonate residues from added precipitated magnesium carbonate at the rate of 28,180 pounds  $\text{CaCO}_3$  equivalences per 2,000,000 pounds of soil. .... 463
- Plate 2. Comparison between effect of residual precipitated calcium carbonate and the non-carbonate residuals from magnesium carbonate upon tall oat grass during period of fertility following initial period of magnesium-induced toxicity. .... 465
- Plate 3. Showing absence of initial magnesium-induced toxicity, early stage of 1917 crop. .... 467
- Plate 4. Showing absence of magnesium-induced toxicity upon cowpea crops 1917. .... 469
- Plate 5. Showing initial toxicity induced by treatments of  $\text{MgCO}_3$  equivalent to 28,180 pounds  $\text{CaCO}_3$  per 2,000,000 pounds of soil in Wagner pots, and its disappearance after one year. .... 471

### TEXT-FIGURES

#### EFFECT OF CHEMICAL AGENTS ON OXIDATION IN SOIL-FORMING ROCKS AND MINERALS

- Fig. 1. Development of different colors in orthoclase powder treated with various chemical agents. .... 20

#### ACID PHOSPHATE PRODUCTION BY THE LIPMAN PROCESS: II. BUILDING UP SULFUR-FLOATS SOIL MIXTURES WITH A HIGH CONTENT OF TOTAL AND SOLUBLE PHOSPHATE

- Fig. 1. Solubility of  $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$  in  $\text{H}_3\text{PO}_4$  solution. .... 44

#### SOIL ACIDITY AS MEASURED BY SUGAR INVERSION, THE TRUOG TEST AND THE HYDROGEN-ION CONCENTRATION AND ITS RELATION TO THE HYDROLYSIS OF ETHYL ACETATE

- Fig. 1. Comparison of results obtained on 23 different soils with soil acidity methods indicated. .... 102
2. Comparison of results obtained on 8 soils variously treated with soil acidity methods indicated. .... 104

#### ADSORPTION AND REPLACEMENT OF PLANT FOOD IN COLLOIDAL OXIDES OF IRON AND ALUMINUM

- Fig. 1 Concentrations. .... 160
2. Concentrations. .... 160

#### A COMPARISON OF THE ABSORPTION OF INORGANIC ELEMENTS, AND OF THE BUFFER SYSTEMS OF LEGUMES AND NON-LEGUMES, AND ITS BEARING UPON EXISTING THEORIES

- Fig. 1 to 4. Titration of 25 cc. sap: Barley tops grown for 36 days, pea tops grown for 36 days, barley tops grown for 51 days, and pea tops grown for 51 days. .... 198
- 5 to 8. Titration of 25 cc. sap: barley roots grown for 51 days, pea roots grown for 51 days, bean tops grown for 36 days, pea roots grown for 36 days. .... 199
- 9 to 12. Titration of 25 cc. sap (Control solution): barley and bean tops grown together; barley and bean roots grown together; barley tops; pea tops. ... 201

SULFUR, CALCIUM, MAGNESIUM AND POTASSIUM CONTENT AND REACTION OF RAINFALL AT  
DIFFERENT POINTS IN TENNESSEE

- Fig. 1. Map of the State of Tennessee, showing the locations of the ten sampling points  
at which rainfall was collected in standard 8-inch gauges..... 206

ON THE QUESTION OF OBTAINING THE SOIL SOLUTION

- Fig. 1. Diagram of apparatus for extraction of soil solution by atmospheric pressure.... 236

AERATION METHOD FOR DETERMINING AMMONIA IN ALKALI SOILS

- Fig. 1. Aeration apparatus..... 262  
2. Heating arrangement..... 263

THE RELATION OF SEED WEIGHT TO THE GROWTH OF BUCKWHEAT IN CULTURE SOLUTION

- Fig. 1. Graphs of average green weights of plants grown in solution cultures from seeds  
which produced the highest and lowest yields..... 288  
2. Diagram comparing average relative dry weights with average relative leaf  
areas of plants grown from seeds of different weights..... 290

SOLUBILITY OF LIMESTONES AS RELATED TO THEIR PHYSICAL PROPERTIES

- Fig. 1. Effect of application of 50-mesh limestone materials upon  $\text{CaCO}_3$  requirement of  
acid DeKalb sandy loam..... 300  
2. Effect of application of 100-mesh limestone materials upon  $\text{CaCO}_3$  requirement  
of acid DeKalb sandy loam..... 301  
3. Comparison of solubilities of limestone materials studied and their chemical com-  
position and some physical properties..... 302

THE INFLUENCE OF SOLUTION VOLUME UPON PLANT GROWTH IN RELATION TO REACTION  
CHANGE AND IRON AVAILABILITY IN CULTURE SOLUTIONS

- Fig. 1. Graphs of pH values of culture solutions after contact with plant roots during the  
various growth intervals..... 416  
2. Graphs of pH values of culture solutions after contact with plant roots during  
the various growth intervals..... 419  
3. Graphs of pH values of culture solutions after contact with plant roots during  
the various growth intervals..... 423

\* MICRO-SAMPLING FOR THE DETERMINATION OF DISSOLVED OXYGEN

- Fig. 1. Diagram of sampling apparatus for oxygen determinations..... 490

